

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. Sem-II [All Branch] examination June 2009

Subject code: 110006

Subject Name: Elements of Mechanical Engineering

Date: 15/06/2009

Time: 10:30am-1:00pm

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use of steam table is permissible.

Q: 1

(a) What is Prime mover? How are they classified? [03]
(b) With usual notations prove that $C_p - C_v = R$. [04]
(c) A gas whose pressure, volume, and temperatures are 2.75 bar, $0.09m^3$ and $185^\circ C$ respectively has the state changed at constant pressure until its temperature becomes $15^\circ C$. Calculate
(i) Heat Transferred.
(ii) Work Done during the process.
Take $R = 0.29 \text{ KJ/Kg K}$, and $C_p = 1.005 \text{ KJ/Kg K}$.

Q: 2

(a) Define the following terms : [03]
(i) Indicated thermal efficiency.
(ii) Compression ratio.
(iii) Scavenging.

(b) Prove that dryness fraction + wetness fraction = 1. [04]
(c) The following readings were taken during the test on a single cylinder four stroke, Oil engine :

| | |
|----------------------------------|---------------|
| Cylinder diameter | = 270 mm |
| Stroke Length | = 380 mm |
| Mean effective pressure | = 6 bar |
| Engine Speed | = 250 rpm |
| Net load on brake | = 1000 N |
| Effective mean Diameter of brake | = 1.5 m |
| Fuel used | = 10 Kg/Hr |
| C.V. of Fuel | = 44400 KJ/Kg |

Calculate:- (i) Brake Power.
(ii) Indicated Power.
(iii) Mechanical Efficiency.
(iv) Indicated Thermal Efficiency.

OR

(c) A six cylinder 4 Stroke IC Engine is to develop 89.5 KW indicated power at 800 rpm. The stroke to bore ratio is 1.25 : 1. Assuming mechanical efficiency of 80% and brake mean effective pressure of 5 bar. Determine the diameter and stroke Of the Engine. [07]

Q: 3 (a) Explain the essential elements of a Heat Engine. [03]
 (b) Show that the efficiency of Otto cycle is a function of Compression Ratio only. [04]
 (c) In air standard Otto Cycle the Maximum and Minimum temperatures are 1673 K and 288 K. The heat supplied per Kg of air is 800 KJ. Calculate.
 (i) The Compression Ratio.
 (ii) Efficiency.
 (iii) Max & Min Pressures.
 Take $C_v = 0.718 \text{ KJ/Kg K}$ & $\gamma = 1.4$ for air.

OR

Q: 3 (a) Define the following terms in connection with boiler. [03]
 (i) Mountings.
 (ii) Actual Evaporation.
 (iii) Boiler Efficiency.

(b) Explain with neat sketch the constructional details and working of the Ramsbottom type spring loaded Safety Valve. [04]

(c) A Steam Generator evaporates 18000 Kg/Hr of steam at 12 bar Pressure and steam is 97% dry. Feed water temperature = 105 °C. Coal is fired at the rate of 2050 Kg/Hr. C.V. of Coal is 27400 KJ/Kg. Calculate.
 (i) Heat Supplied per Hour.
 (ii) Thermal Efficiency.
 (iii) Actual Evaporation.

Q: 4 (a) What is the function of Governor? Classify the Governing methods used in I.C. engines and describe quantity method of Governing. [03]
 (b) Prove that the work done per Kg of air in Reciprocating Air Compressor neglecting clearance volume is given by

$$W = RT_1 n / (n-1) [(Rp)^{(n-1)/n} - 1]$$
, Where Rp = Pressure Ratio. [04]
 (c) Air is to be Compressed in a single stage reciprocating compressor from 1.013 bar and 15°C to 7 bar. Calculate the indicated power required for a free air delivery of 0.3 m³ / min when the compression process is.
 (i) Isentropic (ii) Reversible Isothermal
 (iii) Polytropic with $n = 1.25$. What will be the delivery temperature in each case ? Neglect clearance.

OR

Q: 4 (a) Why air conditioning is required in air craft ? [03]
 (b) With neat sketch describe the working of simple vapour compression refrigeration Cycle. (Drawing p-h and T-Ø chart) [04]
 (c) State the different types of centrifugal pumps. Describe diffuser type of centrifugal pump. [07]

Q: 5 (a) What is function of Coupling? Name only various types of couplings. Explain Oldham coupling. [04]
 (b) Write short note on Helical gear. [04]
 (c) What are bearings? How are they classified? Explain Thrust Bearing. [06]

OR

Q: 5 (a) **Write short notes on :** [06]
 (i) CNG
 (ii) Composite materials.

(b) State and explain Zeroth law of Thermodynamics. [04]
 (c) Enlist physical properties of Engineering materials [04]
